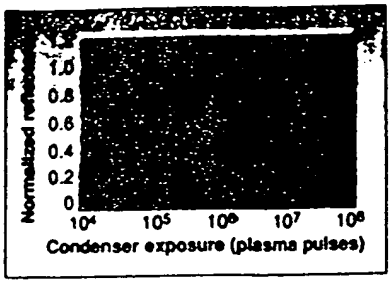

FIGURE 2. Unlike solid-target plasma sources, gas-jet plasma source does not degrade the reflectance of system optics by sputtering debris onto optical surfaces. Reflectance lifetimes for optics used with the gas-jet system (data points) are thus significantly higher than for conventional solid-target systems (solid line).

spaced 100 mm from the plasma source. Mirror reflectance dropped by 15% after 5×10^7 pulses, significantly better than existing systems, but below the requirements for lithography applications. Extensive studies of the mirror surface, however, showed that the primary mechanism for this loss was copper film deposited from the cooling yoke by the diffuse plasma.

After shielding the cooling yoke with molybdenum foil, the group performed a subsequent accelerated lifetime test (witness samples placed 25 mm from the plasma). Analysis of the witness samples demonstrated a reflectance loss of 14% after 9×10^6 pulses, which scales to 1.44×10^9 pulses at the 100-mm distance (see Fig. 2).

Future work will include improving system output power by optimizing gas delivery and by increasing the laser repetition rate to as much as 2000 Hz, probably shifting to continuous rather than pulsed gas-jet delivery. Additional shielding measures should reduce reflectance loss by protecting metal elements of the system from the diffuse plasma.

Kristin Lewotsky

FLAT-PANEL DISPLAYS

Large-screen display improves viewing angles

The size of the display area and general performance of liquid-crystal displays (LCDs) have steadily improved in past years, but an important threshold was achieved recently when both NEC (Tokyo, Japan) and Sharp (Osaka, Japan) announced that they would soon offer LCDs with a diagonal dimension of more than 20 in. These active-matrix displays offer performance about equivalent to a typical 24-in. cathode-ray-tube (CRT) display, but in a slim profile. While the initial cost of the slim displays will be two to four times that of an equivalent CRT, NEC and others are betting that users in many industries will pay a premium to have these flat-panel monitors (see Fig. 1).

The NEC 20.1-in. display is an active-matrix type that requires a transistor at

FIGURE 1. Large-screen (20-in.-diagonal) active-matrix display recently announced by NEC offers performance about equivalent to a typical 24-in. cathode-ray-tube (CRT) display, but in a slim profile. The flat-panel device will cost about three times that of a conventional CRT display.

each pixel location and features a 1280 × 1024-pixel format. The contrast ratio is 150:1, and brightness is 200 cd/m^2, which is about three times as bright as a typical laptop-computer display, but similar to a comparable CRT monitor.

A disadvantage of many LCDs is the limited viewing angle as compared to CRTs. NEC has addressed this problem by using a technique it has dubbed super fine technology (SFT). In conventional thin-film-transistor (TFT) displays, one electrode is placed on the top piece of glass and a second on the bottom piece (see Fig. 2). When a voltage is applied, the naturally twisted structure of the liquid-crystal molecules are rotated to align and allow light to pass. But this structure leads to the limited viewing angles.

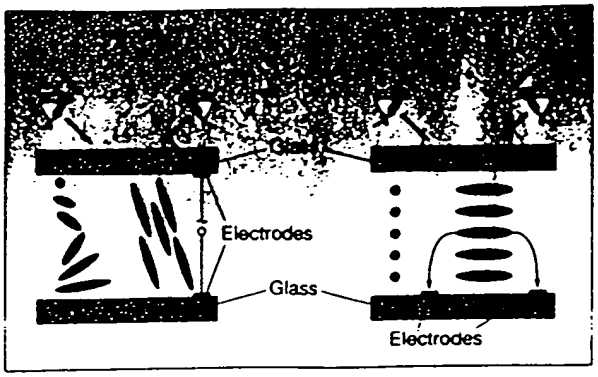

FIGURE 2. Electrodes are placed on both the top and bottom pieces of glass in a conventional thin-film-transistor (TFT) display (left). When a voltage is applied, the naturally twisted structure of the liquid crystal molecules is rotated to align and allow light to pass. This structure leads to a typical horizontal viewing angle of ±45° and vertical viewing angle between 20° and 40°. Electrodes are placed only on the bottom glass in a super-fine technology (SFT) display. When off, the liquid crystals are aligned without a twisted structure. Application of a voltage rotates these molecules in one plane only. As a result, there is no deterioration of the viewing angles, which produces a symmetric viewing cone of 80° surrounding the display surface normal (right).

With SFT, electrodes are placed only on the bottom glass. In their off state, the liquid crystals are aligned without a twisted structure. Application of a voltage rotates these molecules in one plane only, and there is no deterioration of the viewing angles. The NEC technique provides a symmetric viewing cone of 80° surrounding the display surface normal—essentially at parity with CRTs.

These displays use analog display drivers so that the analog signals in conventional desktop-computer CRT monitors can directly run the new flat-panel monitor. Other developers of flat-panel monitors use more-common digital drivers to drive their dis-

plays. But for desktop-computer operation, the analog computer signal must first be converted to digital and appropriately formatted. Both these approaches are suitable for flat-panel monitors that can directly replace CRTs.

The company plans to begin ramping up production of its 20-in. display in the first quarter of 1997, with a volume OEM price of about $5000. According to Michael Hasegawa, staff product marketing engineer at NEC, "Developers of multimedia applications, financial brokers, high-end medical diagnostic and industrial equipment, and information kiosks are the primary targets for these larger-sized displays. Not only is the space and weight-saving an issue, but the lower electromagnetic emissions of LCDs and reduced eye strain are key considerations in replacing CRT monitors."

An alternative approach

Sharp is championing an alternative all-digital-driver approach typical of notebook computers. Here, the signal remains digital from video controller card to display. For this concept to move to desktop computers, however, users will have to insert a new digital video card into their computers, and standards will have to be developed to govern the interface.

To service this potentially huge market, Sharp is developing both TFT and supertwist nematic (STN) displays in larger sizes. The company recently increased its largest available display from a 17.7-in. STN to a 21.4-in. model that features 1024 × 768 pixels and is thought to use several new Sharp technologies. Previous products have demonstrated the Sharp addressing scheme that boosts pixel response to about 100 ms, approaching the 50-ms response of TFTs and the minimum needed for good video response. Viewing-angle-enhancement techniques also have shown improvements of 50% over conventional STN displays.

While performance is still not as good as TFT devices, STN devices are less expensive displays. Sharp's pricing for the 21.4-in. STN display is projected to be about $2000, when they are available next April.

Chris Chinnock

CHRIS CHINNOCK is a technical writer based in Norwalk, CT 06850.

NONLINEAR OPTICAL MATERIALS

Conference achieves record attendance

PALO ALTO, CA—More than 100 representatives of the laser and electro-optics industries from around the world attended the recent Center for Nonlinear Optical Materials (CNOM) annual